P3H1 gene

prolyl 3-hydroxylase 1

Normal Function

The *P3H1* gene provides instructions for making an enzyme called prolyl-3 hydroxylase 1 (sometimes known as leprecan). This enzyme works with two other proteins, cartilage associated protein and cyclophilin B, as part of a complex that helps process certain forms of collagen. Collagens are proteins that provide strength, support, and the ability to stretch (elasticity) to many body tissues.

The complex modifies a protein building block (amino acid) called proline in collagen molecules. This modification, which is known as proline 3-hydroxylation, appears to be critical for the normal folding and assembly of collagen. It also may be important for releasing collagen molecules into the spaces around cells (the extracellular matrix). The secretion of collagen from cells is necessary for the proper formation of connective tissues, such as bones, tendons, and cartilage, that form the body's supportive framework.

Studies suggest that prolyl-3 hydroxylase 1 has several additional functions. For example, this enzyme may play a role in interactions between certain types of cells and the extracellular matrix that surrounds them. Other research indicates that prolyl-3 hydroxylase 1 may act as a tumor suppressor, preventing cells from growing and dividing too fast or in an uncontrolled way.

Health Conditions Related to Genetic Changes

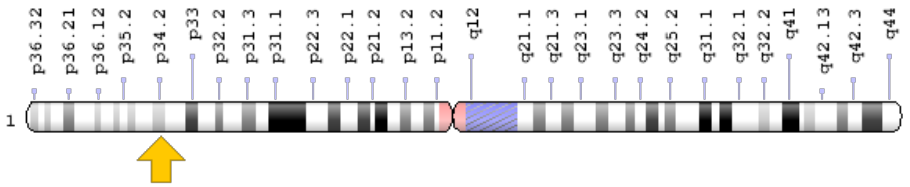
osteogenesis imperfecta

At least four mutations in the *P3H1* gene have been identified in people with a rare, severe form of osteogenesis imperfecta classified as type VIII. These mutations prevent cells from producing any functional prolyl-3 hydroxylase 1. Without this enzyme, certain forms of collagen are not modified through proline 3-hydroxylation. The altered collagen molecules are incorrectly folded, and some abnormal collagen is secreted from cells more slowly than usual. These collagen defects weaken connective tissues, resulting in extremely slow growth and thin, brittle bones that may fracture before birth.

Chromosomal Location

Cytogenetic Location: 1p34.2, which is the short (p) arm of chromosome 1 at position 34.2

Molecular Location: base pairs 42,746,335 to 42,767,084 on chromosome 1 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- GROS1
- growth suppressor 1
- Leucine- and proline-enriched proteoglycan 1
- MGC117314
- P3H1_HUMAN

Additional Information & Resources

Educational Resources

- Molecular Biology of the Cell (fourth edition, 2002): Collagens Are the Major Proteins of the Extracellular Matrix
  https://www.ncbi.nlm.nih.gov/books/NBK26810/#A3551
- Molecular Cell Biology (fourth edition, 2000): Collagen: The Fibrous Proteins of the Matrix
  https://www.ncbi.nlm.nih.gov/books/NBK21582/
- National Institute of Child Health and Human Development: Second Gene Discovered for Recessive Form of Brittle Bone Disease (February 8, 2007)
  https://www.nih.gov/news-events/news-releases/second-gene-discovered-recessive-form-brittle-bone-disease
- The Cell: A Molecular Approach (second edition, 2000): Collagen fibrils (figure)
  https://www.ncbi.nlm.nih.gov/books/NBK9874/?rendertype=figure&id=A2050

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28LEPRE1%5BTIAB%5D%29+OR+%28leprecan%5BTIAB%5D%29%29+OR+%28%28GROS1%5BALL%5D%29+OR+%28P3H1%5BALL%5D%29%29+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- PROLYL 3-HYDROXYLASE 1
  http://omim.org/entry/610339

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_P3H1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=P3H1%5Bgene%5D
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=19316
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/64175
- UniProt
  http://www.uniprot.org/uniprot/Q32P28

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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17277775
- Kaul SC, Sugihara T, Yoshida A, Nomura H, Wadhwa R. Gros1, a potential growth suppressor on chromosome 1: its identity to basement membrane-associated proteoglycan, leprecan. Oncogene. 2000 Jul 27;19(32):3576-83.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10951563
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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17630507

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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15044469
- Wassenhove-McCarthy DJ, McCarthy KJ. Molecular characterization of a novel basement membrane-associated proteoglycan, leprecan. J Biol Chem. 1999 Aug 27;274(35):25004-17.
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